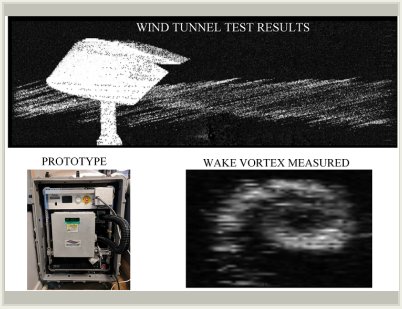
3D Flow Field Measurements using Aerosol Correlation Velocimetry, Phase II

Completed Technology Project (2016 - 2019)

Project Introduction

AeroMancer Technologies proposes to develop a 3D Global Lidar Airspeed Sensor (3D-LGAS) using Aerosol Correlation Velocimetry for standoff sensing of high-resolution spatially and temporally resolved three-component global airspeeds using a scanning elastic lidar. The proposed instrument uses range-resolved elastic backscatter data from a scanning lidar beam to generate a 3D map of aerosol density in a short time span. Aerosol density fluctuations are cross-correlated between successive scans to obtain the displacements of the aerosol features along the three axes. Current methods of non-intrusive global airspeed measurement include Particle Imaging Velocimetry (PIV) and Doppler Global Velocimetry (DGV). Common drawbacks of these methods are that they require precise alignment of separate transmitters and receivers; and it is expensive and unwieldy to extend these measurements for use in medium and large wind tunnels. In Phase I, AeroMancer identified the main requirements of the application and the instrument; developed a conceptual design of a Phase II prototype; identified 3D airspeed extraction algorithms; and benchmarked the performance of the prototype using experiments and numerical simulations. In Phase II, AeroMancer will develop the final design of the prototype by finalizing the requirements; and by performing trade studies and an eye safety analysis to select major components. The prototype will then be fabricated, assembled and packaged for wind tunnel use. Algorithms for the extraction of 3D global airspeeds, turbulence and solid object identification will be developed. Different scanning approaches will be developed and sources of error in the measurement will be analyzed and quantified. Software packages for control, data acquisition, storage and processing will be developed. The prototype will be tested in the laboratory for alignment, calibration, verification and validation. Limited wind tunnel testing will be performed if resources permit.



3D Flow Field Measurements using Aerosol Correlation Velocimetry, Phase II

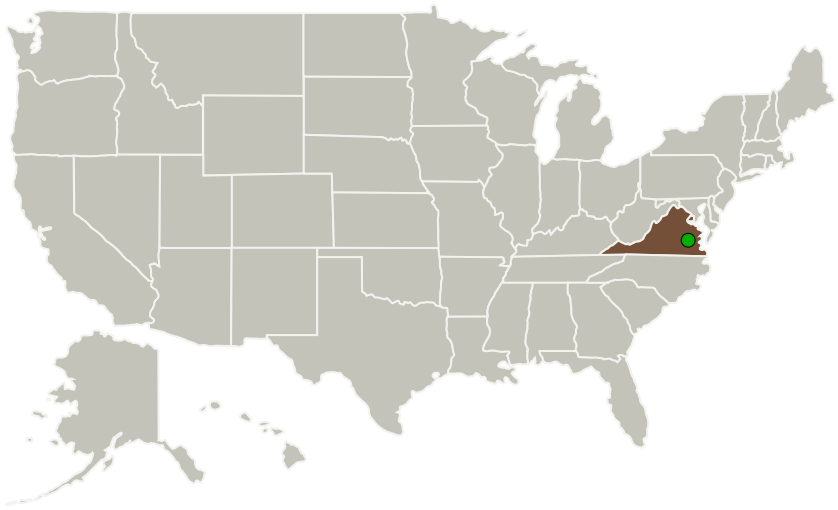
Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

3D Flow Field Measurements using Aerosol Correlation Velocimetry, Phase II

Completed Technology Project (2016 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
AeroMancer Technologies Corporation	Lead Organization	Industry Small Disadvantaged Business (SDB)	Washington, District of Columbia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
District of Columbia	Virginia

Project Transitions

September 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

AeroMancer Technologies Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

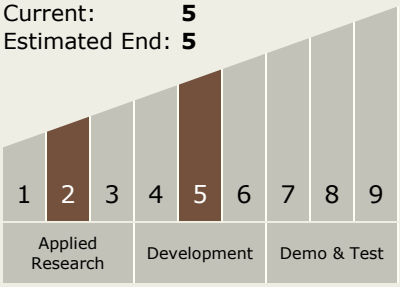
Carlos Torrez

Co-Investigator:

Anand Radhakrishnan

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



3D Flow Field Measurements using Aerosol Correlation Velocimetry, Phase II

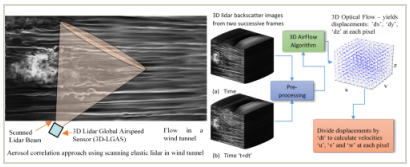
Completed Technology Project (2016 - 2019)

March 2019: Closed out

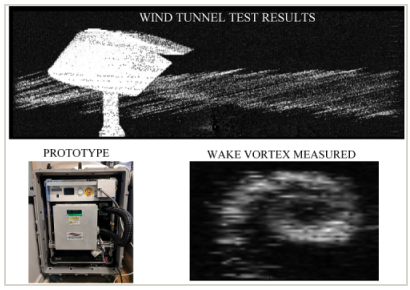
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140792)*

Images



Briefing Chart Image
3D Flow Field Measurements using Aerosol Correlation Velocimetry, Phase II
(https://techport.nasa.gov/image/128884)



Final Summary Chart Image
3D Flow Field Measurements using Aerosol Correlation Velocimetry, Phase II
(https://techport.nasa.gov/image/133234)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System